NERRS Science Collaborative Progress Report for the Period 03/01/11 through 08/31/11

Project Title: Determining the role of estuarine 'swashes' on water quality impairment along the Grand Strand of South Carolina: Impacts of land use and stormwater runoff.
Principal Investigator(s): Dr. Erik M. Smith
Project start date: September 15, 2010
Report compiled by: Dr. Erik M. Smith
Contributing team members and their role in the project:
M. Richard DeVoe – Integration Co-lead
Dr. Denise M. Sanger – Integration Co-lead
Leigh Wood – Local Outreach Facilitation
Dr. Susan Libes – Research Co-PI
Dr. Richard Viso – Research Co-PI
Dr. Richard Peterson – Research Co-PI
Dr. Jennifer Plunket – Research Co-PI

A. Progress overview: The overall project goal is to address how land use attributes and stormwater management practices and conveyance within swash watersheds affect nutrient and organic matter loading to those swashes, their internal transformations, and subsequent export to the coastal ocean. The ultimate intent is to enable effective management strategies, based on sound science, that improve and protect coastal water quality, particularly with respect to hypoxia, in Long Bay. To do so, the following key project objectives have been identified: 1) Work with intended users to define and develop a categorization scheme for all 14 swashes and select 4 swashes for intensive investigation during the proposed study; 2) Quantify concentrations and forms of nutrient and organic matter entering swashes via surface water and groundwater inputs; 3) Determine internal conditions and processes affecting organic matter transport and transformations in swashes; 4) Quantify the form and net tidal export of nutrients and organic matter from swashes; 5) Engage intended users to enable use of data to collaboratively develop science-based cost-effective management strategies.

To accomplish the above project goal, our intention during this reporting period was to develop a 'straw man' categorization scheme; convene a second workshop with intended users to collaboratively select the 4 swashes for intensive study; and begin sampling the two swashes selected for study in Year 1. Several 'straw man' categorization schemes were developed with help from several of the Intended User community. A second workshop was held with the intended users and researchers on April 6, 2011 in Myrtle Beach, SC to present a 'straw man' swash classification scheme, vet and formalize the scheme, then use that finalized scheme to collaboratively select the 4 swashes for intensive study. The workshop was very successful and resulted in both a final categorization scheme for the swashes and 2 swashes for sampling in Year 1. The group decided that the determination of the 2 swashes for Year 2 sampling should not be made until results from the first 2 swashes were obtained. The 2 swashes chosen for Year 1 sampling include Withers Swash is Myrtle Beach and Dogwood Swash in Surfside Beach. Both swashes have been instrumented and data collection is ongoing.

B. Working with Intended Users: Intended users were engaged in the development of watershed boundaries and identification of appropriate data for use in the categorization scheme. A workshop with intended users was held on April 6, 2010 to to present a 'straw man' swash classification scheme, vet and formalize the scheme, then use that finalized scheme to collaboratively select the 4 swashes for intensive study. The participants at that workshop, other than the full project research team, were as follows:
Kevin Blayton, City of North Myrtle Beach

Janet Wood, City of Myrtle Beach
Dave Fuss, Horry County Stormwater
John Adair, Town of Surfside Beach
Sean Torrens, SC Department of Health and Environmental Control, Environmental Quality Control
Will Salters, SC Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management
David Whitaker, SC Department of Natural Resources
Diane Maskow-MeKenzie, City of Myrtle Beach

Workshop participants were provided with a summary of the 'straw man' categorization schemes as well as all of the data used to develop them. Intended users were specifically asked for input on the categorization of the swashes and for working with the researchers to determine which of the swashes were most appropriate to sample in Year 1. The workshop was very engaging and successful. A final categorization scheme was developed and 2 swashes were chosen for the first year of sampling.

The outreach team is working with the intended users in both the Town of Surfside Beach and City of Myrtle Beach to determine the appropriate audiences to target for each area. We are currently developing "Watershed Walks" for both Dogwood Swash (Town of Surfside Beach) and Withers Swash (City of Myrtle Beach). These interpretative tours are anticipated to occur in the fall of this year, and they will highlight the Swash Project and provide an overview of the drainage patterns, surrounding land use, and water quality impairments within the basins. Targeted audiences will be determined based on the need in each area but could include storm water engineers and commissions, public works, planners, town managers, council members, and concerned citizens. Additional "Watershed Walks" will also be offered for the swash basins selected for Year 2 of the project. Contact Leigh Wood if you are interested in learning more. In addition, we are starting the process of updating various groups on the project and progress as appropriate. For example, the Stormwater Commission in the Town of Surfside Beach has been informed of the project and will continue to be updated.

C. Progress on project objectives for this reporting period:
The following five key project objectives were identified for the project: 1) Work with intended users to define and develop a categorization scheme for all 14 swashes and select 4 swashes for intensive investigation during the proposed study; 2) Quantify concentrations and forms of nutrient and organic matter entering swashes via surface water and groundwater inputs; 3) Determine internal conditions and processes affecting organic matter transport and transformations in swashes; 4) Quantify the form and net tidal export of nutrients and organic matter from swashes; 5) Engage intended users to enable use of data to collaboratively develop science-based cost-effective management strategies.

The first objective was largely completed during this time period. The 'straw man' categorization scheme was developed from available data based on the list of criteria identified at the first intended user workshop. The first step was to define the watersheds for each of the 15 swashes. They were delineated based on Horry County Basins that were generated from DEMs and refined by Tom Garigan (Horry County Stormwater Senior Engineer). The available data was then clipped for each swash watershed to provide the information used for the categorization. Nine different descriptors were developed based on three defining characteristics (i.e., development, open water characteristics, and relic estuary) (Figure 1). Seven different categorizations schemes were developed. All of this was presented to the intended users at a second workshop that was held on April 6, 2011 in Myrtle Beach, SC. The

purpose of the workshop was to present a 'straw man' swash classification scheme, vet and formalize the scheme, then use that finalized scheme to collaboratively select the 4 swashes for intensive study. The group discussed the different descriptors and decided the method which used % impervious cover, # of ponds, and tidal connection (identified as 'reduced 2' on Table 1) may be the best descriptors to use for the categorization scheme. In addition, several systems were discussed with regard to where they should be categorized

Once the swashes were categorized, the discussion turned to how the swashes should be chosen for sampling in both Year 1 (n=2) and Year 2 (n=2). It was decided that the swashes for Year 1 should be chosen as an outcome of this workshop but Year 2 swashes should not be chosen until the first year of sampling was drawing to a close. The group would then be able to determine if representative rain events had been sampled in the first year as well as how the two swashes chosen compared to each other. One swash from Group 1 (tidally driven) and one swash from Group 2 (non-tidally driven) were targeted for the first year of sampling. Each swash was discussed as a potential candidate for sampling. At the end of the meeting, two swashes were chosen for sampling in the first year: Withers Swash and Dogwood Swash. Withers Swash is located in the City of Myrtle Beach. It is tidally influenced and is of interest to the surrounding communities with regard to revitalization of the area. Dogwood Swash is located in the Town of Surfside Beach and is not tidally driven. It is of interest to the Town and is also influenced by runoff from unincorporated areas of Horry County. The workshop was a tremendous success.

The second, third and fourth objectives are all related to sampling the inputs, internal processes and outputs from the swashes. Upstream sampling sites have been established for both Withers Swash and Dogwood Swash (Figures 2 and 3). Withers Swash was targeted for sampling in the month of July with a successful wet (July 24-25) and dry (July 7-8) event captured during this time frame. Dogwood Swash was targeted for sampling in the month of August with a successful wet (August 13-14) event captured. Both frequent intermittent rain (violating the no antecedent rain for 72h stipulation for dry event sampling) combined with logistical issues involved in the measurement of radon activities for groundwater discharge measurements has resulted in a prolonged deployment in the Dogwood swash. A dry event was finally captured on September 13, and equipment is scheduled to be moved back to Withers Swash the week of September 19. Sample processing is currently being conducted.

The process of securing private landowner permission for access and installation of sampling gear at the upstream sampling sites took much longer than anticipated. There were also several unexpected issues involving the deployment of continuous radon detectors for groundwater input measurements at upstream sites (availability of power, pump failures, etc). In response to these issues we have altered our approach to measuring groundwater inputs by abandoning the continuous detectors in favor of a periodic grab sampling approach. We are confident that this will still yield desired data outcomes, given evidence for steady-state radon activities at the upstream segments. As a benefit, however, this approach will allow us to increase the spatial resolution of upstream groundwater sampling. As a result of these issues, the project is currently about 2-4 months behind schedule.

The fifth objective is a continuing process which will evolve throughout the project. The interactions discussed above with the Intended Users and other audiences are all important steps toward the development of cost effective management strategies.

Plans for meeting project objectives for the next six months include continuing to sample the two swashes, process samples, conduct various outreach activities, and prepare for the next meeting with the intended user group to discuss the Year 2 swashes for sampling.

D. Benefit to NERRS and NOAA: We have been successful in obtaining some additional funding from the Oceans and Human Health Initiative (OHHI) at NOAAs Hollings Marine Laboratory. The overall goal of this OHHI project is to model the loading of fecal indicator bacteria (FIB) and nutrient levels into Long Bay from surface water discharges along the Grand Strand and relate the findings to the SCDHEC Beach Monitoring Program *Enterococci* data. Therefore, limited *Enterococci* sampling will occur as well as modeling of stormwater runoff from the different sources in the area. This will complement the existing study as well as provide stormwater runoff modeling results to determine if we can develop a loadings budget for the major nonpoint sources into Long Bay.

E. Other: The only obstacles identified at this time are the above discussed delay in initiating sampling due to access issues and logistic issues associated with collection of groundwater inputs at upstream sites. No other activities, products, accomplishments, or obstacles have been identified at this time.

Table 1: Comparison of basin cluster methods for the 15 swashes. The basins fall into four groups based on the various cluster methods. The groups are delineated by the thick lines. The basins were placed in rows together to better visualize how the placement changed between methods.

all data (*method 1*)	all data (*method 2*)	all data (*method 3*)	sum scores	reduced 1	reduced 2	reduced basins
Midway	Midway				Midway	Midway
Withers	Withers		Withers	Withers	Withers	Withers
Singleton	Singleton	Singleton	Singleton	Singleton	Singleton	Singleton
White Point		White Point		White Point		
			Beaver Dam			
			Cane Patch			
Ocean Lakes	Ocean Lakes	Ocean Lakes	Ocean Lakes	Ocean Lakes	Ocean Lakes	Ocean Lakes
Floral	Floral	Floral		Floral	Floral	Floral
Myrtle	Myrtle	Myrtle		Myrtle	Myrtle	
Dogwood	Dogwood	Dogwood		Dogwood	Dogwood	Dogwood
Beaver Dam	Beaver Dam	Beaver Dam			Beaver Dam	
		Deep Head		Deep Head		
			Bear Branch	Bear Branch		
		Cane Patch				
			White Point			
			Midway			
Bear Branch	Bear Branch	Bear Branch			Bear Branch	Bear Branch
Deep Head	Deep Head		Deep Head		Deep Head	Deep Head
Cane Patch	Cane Patch			Cane Patch	Cane Patch	Cane Patch
		Midway	Floral	Midway		
	White Point				White Point	
		Withers				
			Dogwood			
			Myrtle			Myrtle
				Beaver Dam		Beaver Dam
13th Ave S.	13th Ave S.	13th Ave S.	13th Ave S.	13th Ave S.	13th Ave S.	
Surfside	Surfside	Surfside	Surfside	Surfside	Surfside	
16th Ave N	16th Ave N		16th Ave N	16th Ave N	16th Ave N	

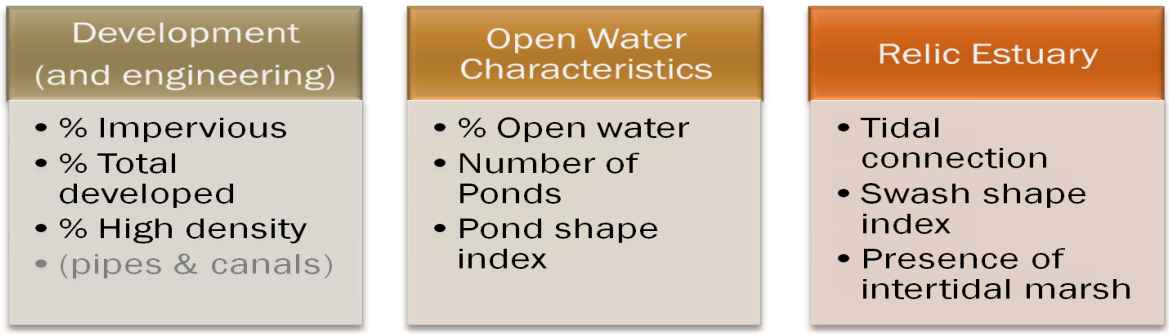

Figure 1. The three defining characteristics and nine descriptors used in the development of the categorization schemes.

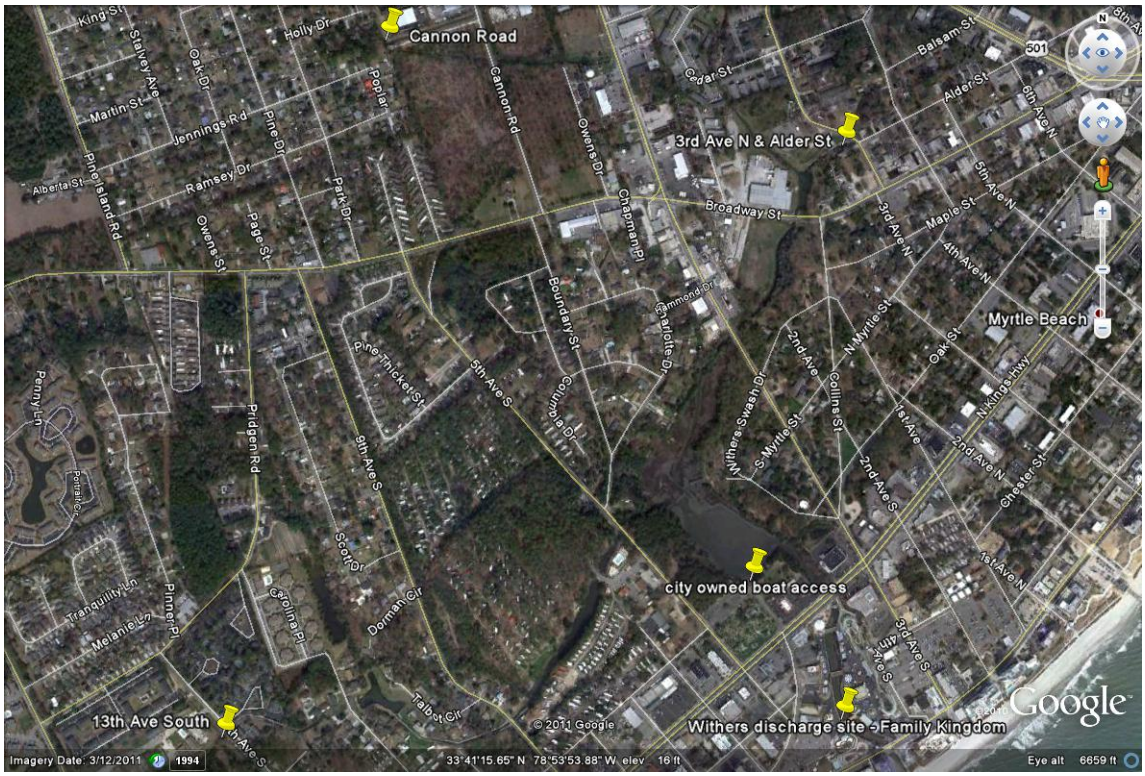

Figure 2. The sampling sites for Withers Swash.

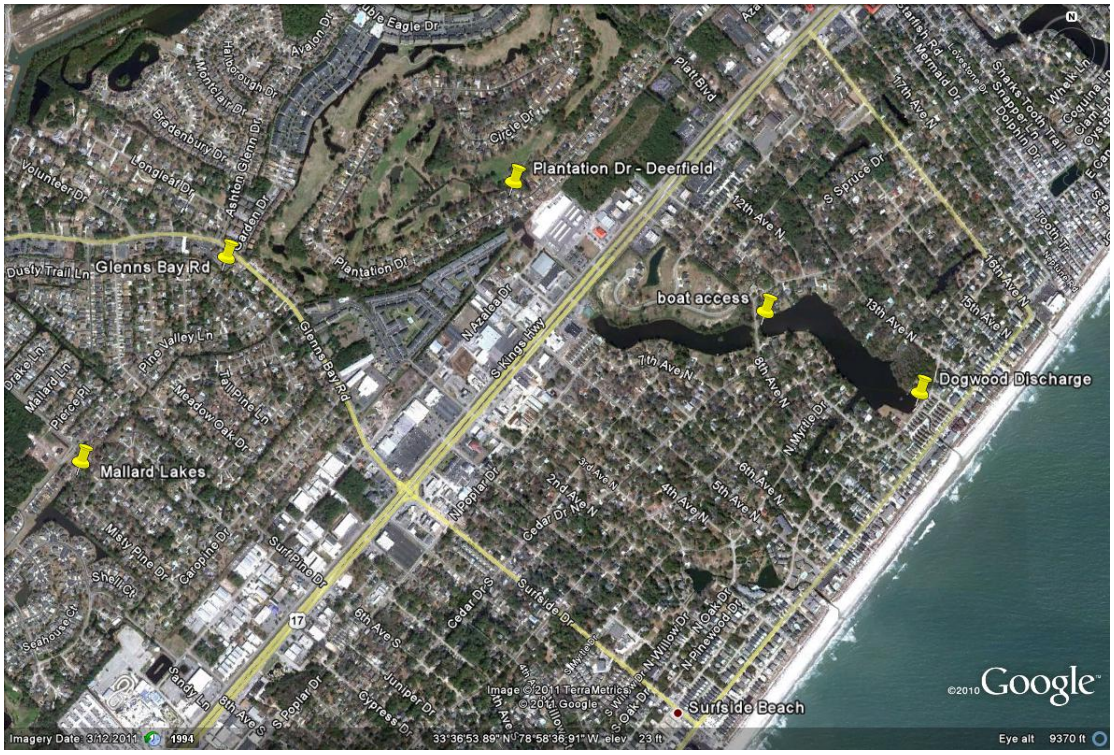

Figure 3. The sampling sites for Dogwood Swash.